JIS

JAPANESE INDUSTRIAL STANDARD

Translated and Published by
Japanese Standards Association

JIS B 0601 : 2001

(ISO 4287 : 1997)

(JSA)

Geometrical Product Specifications (GPS)— Surface texture : Profile method— Terms, definitions and surface texture parameters

ICS 01.040.17; 17.040.20

Descriptors : roughness (surface), smoothness (surface), surface treatment, vocabulary

Reference number : JIS B 0601 : 2001 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by the Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS B 0601 : 1994** is revised, and **JIS B 0660 : 1998** *Surface roughness—Terminology—Part 1 : Surface and its parameters* is withdrawn and integrated into this Standard.

In this Standard "Ten-point mean roughness" which is used in Japan up to now, and "Center line average roughness" according to the former Standard are described in Annex 1 and Annex 2, respectively for information.

Date of Establishment: 1952-05-21

Date of Revision: 2001-01-20

Date of Public Notice in Official Gazette: 2001-01-22

Investigated by: Japanese Industrial Standards Committee
Divisional Council on Machine Elements

JIS B 0601:2001, First English edition published in 2001-11

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents, the original JIS is to be the final authority.

JAPANESE INDUSTRIAL STANDARD

JIS B 0601 : 2001
(ISO 4287 : 1997)

Geometrical Product Specifications (GPS)— Surface texture : Profile method— Terms, definitions and surface texture parameters

Introduction This Japanese Industrial Standard has been prepared based on ISO 4287 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Terms, definitions and surface texture parameters* issued in 1997 without modifying the technical contents.

This Standard is a Geometrical Product Specification (GPS) standard and is to be regarded as a General GPS standard (see **TR B 0007**). It influences chain link 2 of the chains of standards on surface texture. For more detailed information on the relationship of this Standard to other standards and the GPS matrix model, see Annex D.

Historically, the roughness profile and its parameters have been the only parts of surface texture characterization that have been well defined.

A default relationship between λc and λf is under consideration.

In this Standard, ten-point mean roughness which is used in Japan even at present and center line average roughness which had been specified in the former standard are described in Annex 1 and Annex 2, respectively for information.

The portions with solid sidelines or dotted underlines show the matters not included in the original International Standard.

NOTE : **TR B 0007** is identical with **ISO/TR 14638 : 1995** *Geometrical Product Specification (GPS)—Masterplan.*

1 Scope This Standard specifies terms, definitions and parameters for the determination of surface texture (roughness, waviness and primary profile) by profiling methods.

NOTE : The International Standard corresponding to this Standard is as follows.

In addition, abbreviations which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 4287 : 1997 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Terms, definitions and surface texture parameters* (IDT)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0632 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Metrological characteristics of phase correct filters*

NOTE : **ISO 11562 : 1996** *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Metrological characteristics of phase correct filters* is identical with the said standard.

JIS B 0633 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Rules and procedures for the assessment of surface texture*

NOTE : **ISO 4288 : 1996** *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Rules and procedures for the assessment of surface texture* is identical with the said standard.

JIS B 0651 *Surface texture—Instruments for the assessment of surface texture—Profile method*

NOTE : **ISO 3274 : 1996** *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Nominal characteristics of contact (stylus) instruments* is identical with the said standard.

3 Definitions The definitions of terms used in this Standard are as follows.

3.1 General terms

3.1.1 profile filter

filter which separates profiles into longwave and shortwave components

NOTE : There are three filters used in instruments for measuring roughness, waviness and primary profiles (see Figure 1). They all have the same transmission characteristics, defined in **JIS B 0632**, but different cut-off wave-lengths.

3.1.1.1 λs profile filter

filter which defines the intersection between the roughness and the even shorter wave components present in a surface (see Figure 1)

3.1.1.2 λc profile filter

filter which defines the intersection between the roughness and waviness components (see Figure 1)

3.1.1.3 λf profile filter

filter which defines the intersection between the waviness and the even longer wave components present in a surface (see Figure 1)

3.1.2 coordinate system

that coordinate system in which surface texture parameters are defined

NOTE : It is usual to use a rectangular coordinate system in which the axes form a right-handed Cartesian set, the X-axis being the direction of tracing colinear with the mean line, the Y-axis also nominally lying on the real surface, and the Z-axis being in an outward direction (from the material to the surrounding medium). This convention is adopted throughout the rest of this Standard.

3.1.3 real surface

surface limiting the body and separating it from the surrounding medium

3.1.4 surface profile

profile that results from the intersection of the real surface by a specified plane (see Figure 2)

NOTE : In practice, it is usual to choose a plane with a normal that nominally lies parallel to the real surface and in a suitable direction.

3.1.5 primary profile

See **JIS B 0651**. Total profile after application of the short wavelength filter λs.

NOTE : The primary profile is the basis for evaluation of the primary profile parameters.

Informative reference : Total profile is the digital form of the traced profile relative to the reference profile, with the vertical and horizontal coordinates assigned to each other (**JIS B 0651**).

3.1.6 roughness profile

profile derived from the primary profile by suppressing the longwave component using the profile filter λc; this profile is intentionally modified (see Figure 1)

NOTES 1 The transmission band for roughness profiles is defined by the λs and λc profile filters (see **JIS B 0632, 2.6 and 3.2**).

2 The roughness profile is the basis for evaluation of the roughness profile parameters.

3 The default relationship between λc and λs is given in **JIS B 0651, 4.4**.

3.1.7 waviness profile

profile derived by subsequent application of the profile filter λf and the profile filter λc to the primary profile, suppressing the longwave component using the profile filter λf, and suppressing the shortwave component using the profile filter λc; this profile is intentionally modified

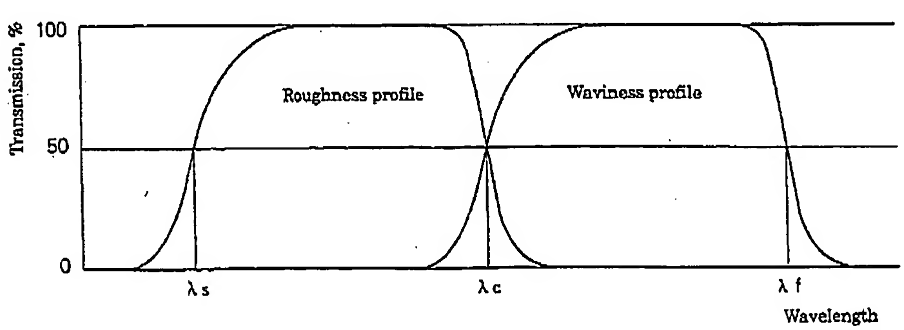


Figure 1 Transmission characteristic of roughness and waviness profiles

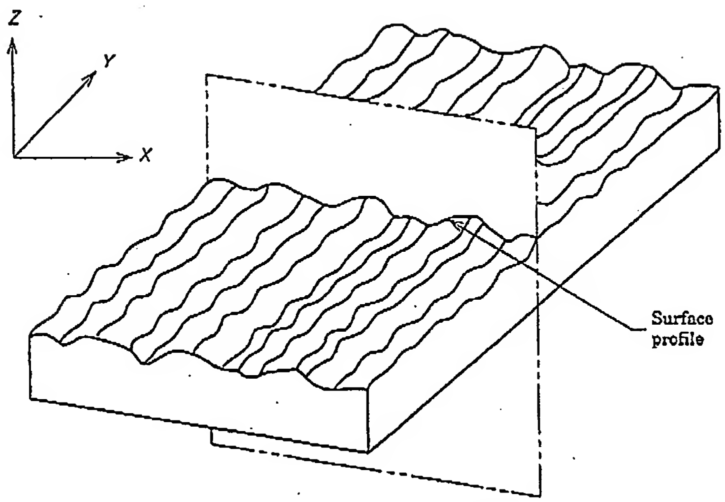


Figure 2 Surface profile

NOTES 1 The nominal form should first be removed from the total profile by best-fit least-squares methods, before applying the λf profile filter for separating the waviness profile. For circular nominal form, it is recommended that the radius should also be included in the least-squares optimization and not held fixed to the nominal value. This procedure for separating the waviness profile defines the ideal waviness operator.

2 The transmission band for waviness profiles is defined by the λc and λf profile filters (see **JIS B 0632, 2.6** and **3.2**).

3 The waviness profile is the basis for evaluation of the waviness profile parameters.

Informative references 1 Operator is a series of measuring principle, measuring method, measuring condition, data processing, etc. which are necessary for obtaining geometrical feature in the order for the purpose of introducing the concept of uncertainty. The ideal is a theoretically correct operator which has no error in measuring instrument and digitalized data, and has infinitively large number of discrete data.

2 The meaning of "the radius should be included in the least-squares optimization" is to obtain the radius of circular form optimally applicable to the data, by the least-squares optimization.

3.1.8 mean lines

3.1.8.1 mean line for the roughness profile

line corresponding to the longwave profile component suppressed by the profile filter λc (see **JIS B 0632, 3.2**)

3.1.8.2 mean line for the waviness profile

line corresponding to the longwave profile component suppressed by the profile filter λf (see **JIS B 0632, 3.2**)

3.1.8.3 mean line for the primary profile

line determined by fitting a least-squares line of nominal form through the primary profile

3.1.9 sampling length lp, lr, lw

length in the direction of the X-axis used for identifying the irregularities characterizing the profile under evaluation

NOTE : The sampling length for the roughness lr and waviness profiles lw is numerically equal to the characteristic wavelength of the profile filters λc and λf, respectively. The sampling length for primary profile, lp, is equal to the evaluation length.

3.1.10 evaluation length ln

length in the direction of the X-axis used for assessing the profile under evaluation

NOTES 1 The evaluation length may contain one or more sampling lengths.

2 For default evaluation lengths, see **JIS B 0633, 4.4. JIS B 0633** does not give default evaluation length for W-parameters.

3.2 Geometrical parameter terms

3.2.1 ***P*-parameter**

parameter calculated from the primary profile

3.2.2 ***R*-parameter**

parameter calculated from the roughness profile

3.2.3 ***W*-parameter**

parameter calculated from the waviness profile

NOTE : The parameters defined in clause 4 can be calculated from any profile. The first capital letter in the parameter symbol designates the type of the profile evaluated. For example, Ra is calculated from the roughness profile and Pt is calculated from the primary profile.

3.2.4 profile peak

an outwardly directed (from material to surrounding medium) portion of the assessed profile connecting two adjacent points of the intersection of the profile with the X-axis

3.2.5 profile valley

an inwardly directed (from surrounding medium to material) portion of the assessed profile connecting two adjacent points of the intersection of the assessed profile with the X-axis

3.2.6 height and/or spacing discrimination

minimum height and minimum spacing of profile peaks and profile valleys of the assessed profile which should be taken into account

NOTE : The minimum height of the profile peaks and valleys are usually specified as a percentage of *Pz*, *Rz*, *Wz* or another amplitude parameter, and the minimum spacing as a percentage of the sampling length.

3.2.7 profile element

profile peak and the adjacent profile valley (see Figure 3)

NOTE : The positive or negative portion of the assessed profile at the beginning or end of the sampling length should always be considered as a profile peak or as a profile valley. When determining a number of profile elements over several successive sampling lengths, the peaks and valleys of the assessed profile at the beginning or end of each sampling length are taken into account once only at the beginning of each sampling length.

3.2.8 ordinate value $Z(x)$

height of the assessed profile at any position x

NOTE : The height is regarded as negative if the ordinate lies below the X-axis, and positive otherwise.

3.2.9 local slope $\frac{dZ}{dX}$

slope of the assessed profile at a position x_i (see Figure 4)

NOTES 1 The numerical value of the local slope, and thus the parameters $P\Delta q$, $R\Delta q$ and $W\Delta q$, depends critically on the ordinate spacing ΔX.

2 A formula for estimating the local slope is

$$\frac{dz_i}{dx_i} = \frac{1}{60\Delta X}(z_{i+3} - 9z_{i+2} + 45z_{i+1} - 45z_{i-1} + 9z_{i-2} - z_{i-3})$$

The above formula should be used for the sample spacing stipulated in **JIS B 0651** for the filter used, where x_i and z_i are the position and the height respectively of the ith profile point and ΔX is the spacing between adjacent profile points.

Informative reference : The formula for obtaining a local slope is based on seven-point formula of numeric differential.

3.2.10 profile peak height Zp

distance between the X-axis and the highest point of the profile peak (see Figure 3)

3.2.11 profile valley depth Zv

distance between the X-axis and the lowest point of the profile valley (see Figure 3)

3.2.12 profile element height Zt

sum of the height of the peak and depth of the valley of a profile element (see Figure 3)

3.2.13 profile element width *Xs*

length of the *X*-axis segment intersecting with the profile element (see Figure 3)

3.2.14 material length of profile at the level *c*, *Ml*(*c*)

sum of the section lengths obtained, intersecting with the profile element by a line parallel to the *X*-axis at a given level, *c* (see Figure 5)

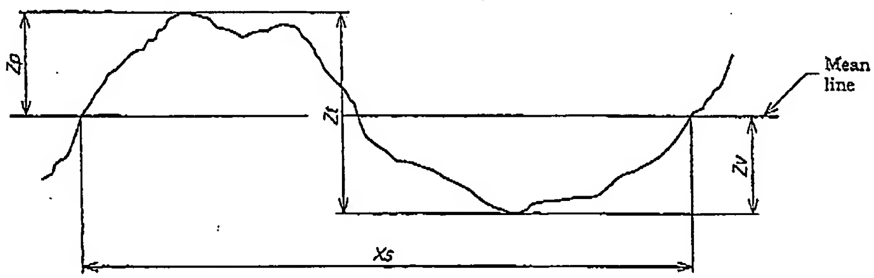


Figure 3 Profile element

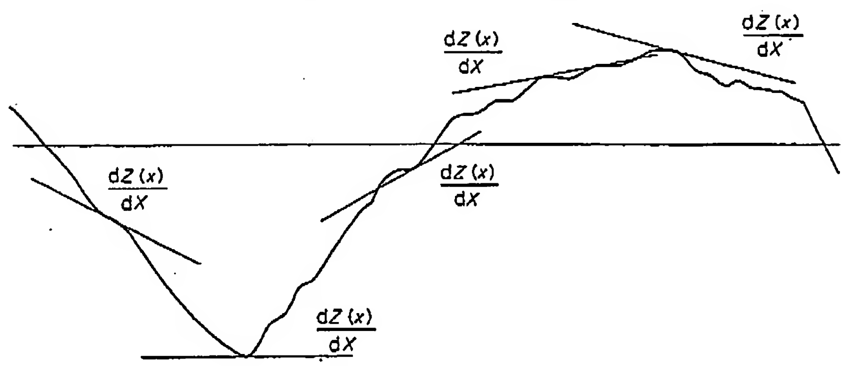


Figure 4 Local slope

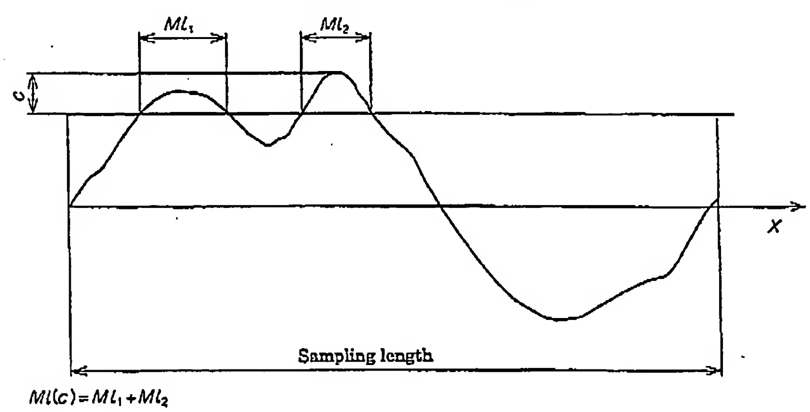


Figure 5 Material length

4 Surface profile parameter definitions

4.1 Amplitude parameters (peak and valley)

4.1.1 maximum profile peak height *Pp*, *Rp*, *Wp*

largest profile peak height *Zp* within a sampling length (see Figure 6)

Informative reference : The parameter is defined that *Pp* is "maximum profile peak height of primary profile", *Rp* is maximum profile peak height of roughness profile" and *Wp* is "maximum profile peak height of waviness profile" which result in the replacement with the names of profiles relating to "profile". Hereafter the same rule applies. However, for a part of parameter of roughness profile and waviness profile, the terms familiarized traditionally or easy to call are used.

4.1.2 maximum profile valley depth *Pv*, *Rv*, *Wv*

largest profile valley depth *Zv* within a sampling length (see Figure 7)

4.1.3 maximum height of profile *Pz*, *Rz*, *Wz*

sum of height of the largest profile peak height *Zp* and the largest profile valley depth *Zv* within a sampling length (see Figure 8)

NOTE : In **ISO 4287** : 1984, the *Rz* symbol was used to indicate the "ten point height of irregularities". In some countries there are surface roughness measuring instruments in use which measure the former *Rz* parameter. Therefore, care must be taken when using existing technical documents and drawings because differences between results obtained with different types of instruments are not always negligibly small.

Informative reference : If the profile is the roughness profile, *Rz* is "roughness of maximum height" and if the surface profile is the waviness profile, *Wz* is "waviness of maximum height".

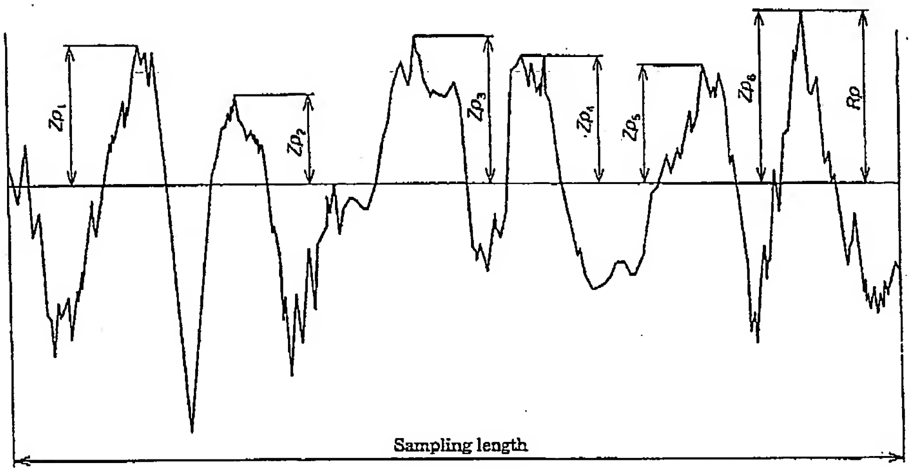


Figure 6 Maximum profile peak height (example of a roughness profile)

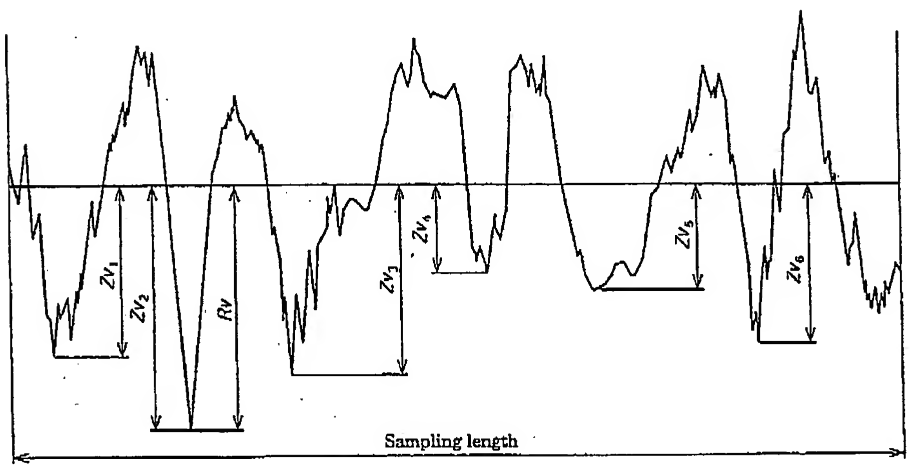


Figure 7 Maximum profile valley depth (example of a roughness profile)

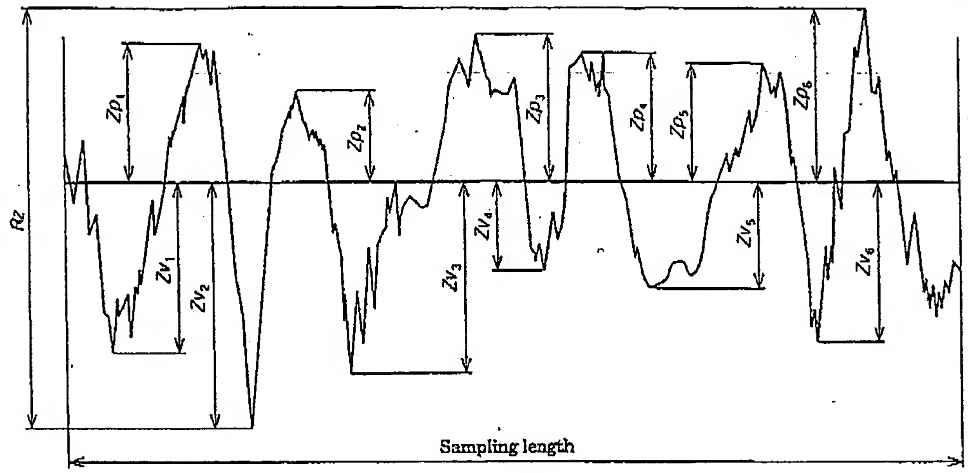


Figure 8 Maximum height of profile (example of a roughness profile)

4.1.4 mean height of profile elements *Pc, Rc, Wc*

mean value of the profile element heights *Zt* within a sampling length (see Figure 9)

$$Pc,\ Rc,\ Wc = \frac{1}{m}\sum_{i=1}^{m} Zt_i$$

NOTE : The parameters *Pc, Rc, Wc* require height and spacing discrimination. If not otherwise specified, the default height discrimination shall be 10 % of *Pz, Rz, Wz*, respectively, and the default spacing discrimination shall be 1 % of the sampling length. Both conditions shall be met.

4.1.5 total height of profile *Pt, Rt, Wt*

sum of the height of the largest profile peak height *Zp* and the largest profile valley depth *Zv* within the evaluation length

NOTES 1 Since *Pt, Rt* and *Wt* are defined over the evaluation length rather than the sampling length, the following will always be true for any profile:

$$Pt \geq Pz,\ \ Rt \geq Rz,\ \ Wt \geq Wz$$

2 In the default case *Pz* is equal to *Pt*. In this case the use of *Pt* is recommended.

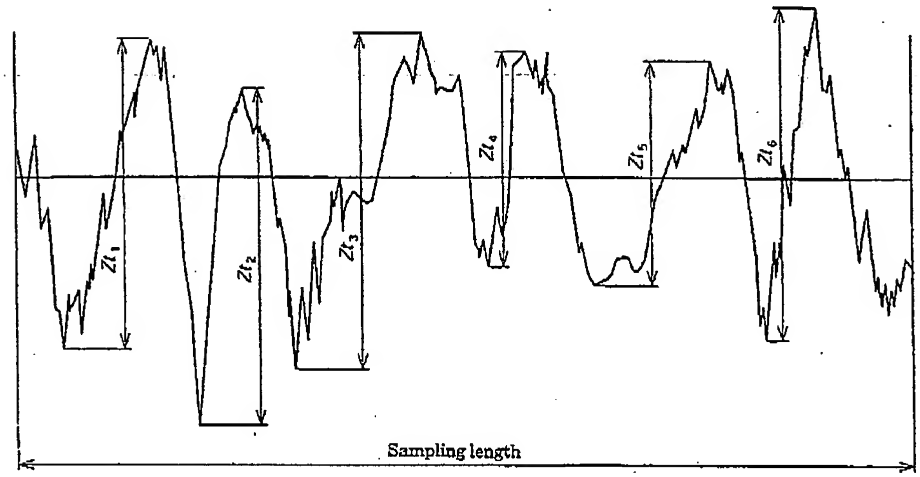


Figure 9 Height of profile elements (example of a roughness profile)

4.2 Amplitude parameters (average of ordinates)

4.2.1 arithmetical mean deviation of the assessed profile *Pa, Ra, Wa*

arithmetic mean of the absolute ordinate values $Z(x)$ within a sampling length

$$Pa,\ Ra,\ Wa = \frac{1}{l}\int_0^l |Z(x)|\,\mathrm{d}x$$

with $l = lp$, lr or lw according to the case.

Informative reference : If the profile is the roughness profile, *Ra* is called "arithmetic mean roughness" which is traditionally familiar term and if the profile is the waviness profile *Wa* is called "arithmetic mean waviness".

4.2.2 root mean square deviation of the assessed profile *Pq, Rq, Wq*

root mean square value of the ordinate values $Z(x)$ within a sampling length

$$Pq,\ Rq,\ Wq = \sqrt{\frac{1}{l}\int_0^l Z^2(x)\,\mathrm{d}x}$$

with $l = lp$, lr or lw according to the case.

Informative reference : If the profile is the roughness profile, *Rq* is called "root mean square roughness" and if the profile is the waviness profile, *Wa* is called "root mean square waviness".

4.2.3 skewness of the assessed profile *Psk, Rsk, Wsk*

quotient of the mean cube value of the ordinate values $Z(x)$ and the cube of *Pq*, *Rq* or *Wq* respectively, within a sampling length

$$Rsk = \frac{1}{Rq^3}\left[\frac{1}{lr}\int_0^{lr} Z^3(x)\,\mathrm{d}x\right]$$

NOTES 1 The above equation defines *Rsk*; *Psk* and *Wsk* are defined in a similar manner.

2 *Psk*, *Rsk* and *Wsk* are measures of the asymmetry of the probability density function of the ordinate values.

3 These parameters are strongly influenced by isolated peaks or isolated valleys.

4.2.4 kurtosis of the assessed profile *Pku*, *Rku*, *Wku*

quotient of the mean quartic value of the ordinate values $Z(x)$ and the fourth power of *Pq*, *Rq* or *Wq* respectively within a sampling length

$$Rku = \frac{1}{Rq^4}\left[\frac{1}{lr}\int_0^{lr} Z^4(x)\,\mathrm{d}x\right]$$

NOTES 1 The above equation defines *Rku*; *Pku* and *Wku* are defined in a similar manner.

2 *Pku*, *Rku* and *Wku* are measures of the sharpness of the probability density function of the ordinate values.

3 These parameters are strongly influenced by isolated peaks or isolated valleys.

4.3 Spacing parameters

4.3.1 mean width of the profile elements *PSm*, *RSm*, *WSm*

mean value of the profile element widths *Xs* within a sampling length (see Figure 10)

$$PSm,\ RSm,\ WSm = \frac{1}{m}\sum_{i=1}^{m} Xs_i$$

NOTE : The parameters *PSm*, *RSm*, *WSm* require height and spacing discrimination. If not otherwise specified, the default height discrimination shall be 10 % of *Pz*, *Rz*, *Wz* respectively, and the default spacing discrimination shall be 1 % of the sampling length. Both conditions shall be met.

4.4 Hybrid parameters

4.4.1 root mean square slope of the assessed profile $P\Delta q$, $R\Delta q$, $W\Delta q$

root mean square value of the ordinate slopes d*Z*/d*X*, within the sampling length

4.5 Curves and related parameters

NOTE : All curves and related parameters are defined over the evaluation length rather than the sampling length, as this provides more stable curves and related parameters.

4.5.1 material ratio of the profile $Pmr(c)$, $Rmr(c)$, $Wmr(c)$

ratio of the material length of the profile elements $Ml(c)$ at a given level c to the evaluation length

$$Pmr(c),\ Rmr(c),\ Wmr(c) = \frac{Ml(c)}{ln}$$

4.5.2 material ratio curve of the profile (Abbott Firestone curve)

curve representing the material ratio of the profile as a function of levels c (see Figure 11)

NOTE : This curve can be interpreted as the sample cumulative probability function of the ordinate values $Z(x)$, within an evaluation length.

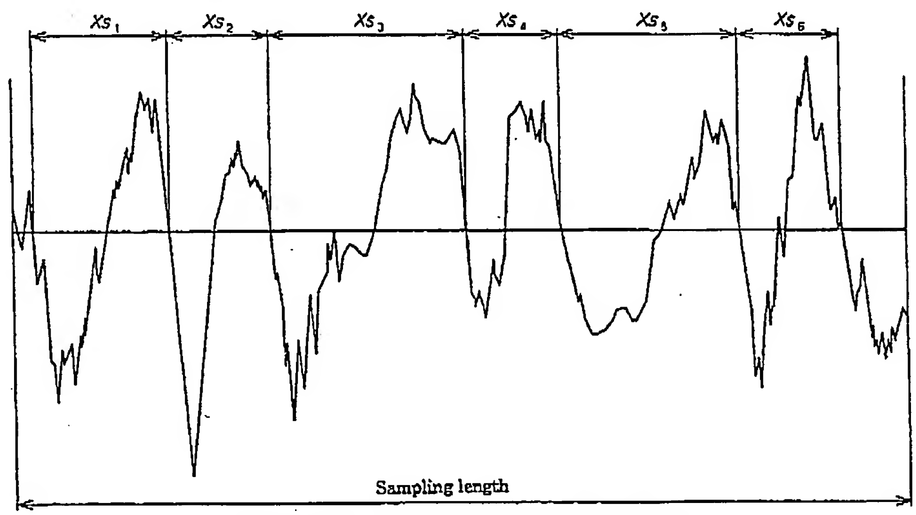


Figure 10 Width of profile elements

4.5.3 profile section height difference $P\delta c$, $R\delta c$, $W\delta c$

vertical distance between two section levels of given material ratio (see Figure 12)

$$R\delta c = c(Rmr1) - c(Rmr2)\ ;\ Rmr1 < Rmr2$$

NOTE : The above equation defines $R\delta c$; $P\delta c$ and $W\delta c$ are defined in a similar manner.

Informative references 1 If the height direction is positive, Figure 11 and Figure 12 can be obtained even if the reference (original) of the section level c is optional set. However, because c is not necessarily 0 at $Rmr(c) = 100\ \%$, the position of the original point should be indicated with the percent of $Rmr(c)$. The example in Figure 5 is based on the position of the maximum profile peak.

2 In the original International Standard, $C(Rmr1) - C(Rmr2)$ is used. However, for making conform to 4.5.1, small letter c is used instead of capital C.

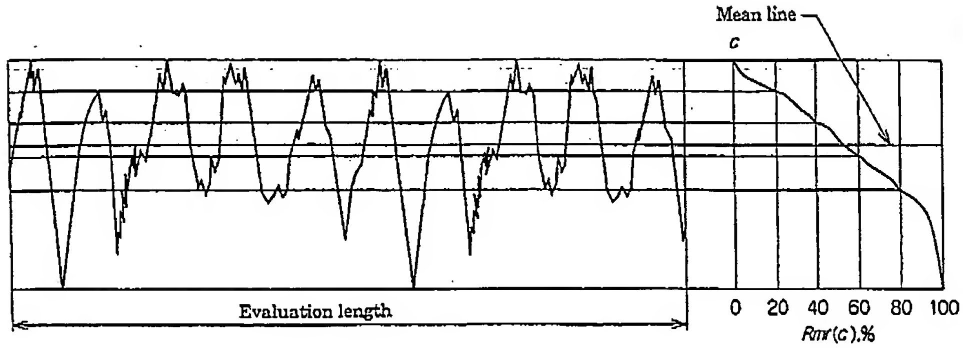


Figure 11 Material ratio curve (example of a roughness profile)

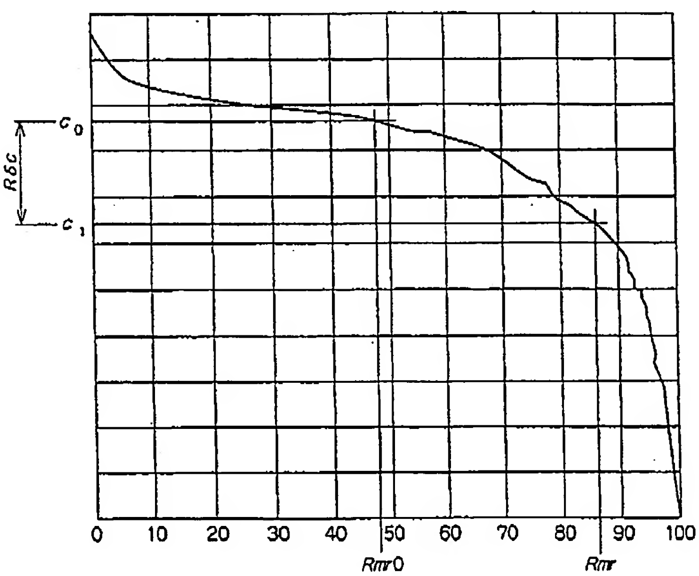


Figure 12 Profile section level separation (example of a roughness profile)

4.5.4 relative material ratio *Pmr*, *Rmr*, *Wmr*

material ratio determined at a profile section level $R\delta c$, related to a reference c_0 (see Figure 12)

$$Pmr,\ Rmr,\ Wmr = Pmr(c_1),\ Rmr(c_1),\ Wmr(c_1)$$

where, $c_1 = c_0 - R\delta c$ (or $P\delta c$ or $W\delta c$)

$c_0 = c(Pmr0,\ Rmr0,\ Wmr0)$

4.5.5 profile height amplitude curve

sample probability density function of the ordinate $Z(x)$ within the evaluation length (see Figure 13)

NOTE : For profile height amplitude curve parameters, see **4.2**.

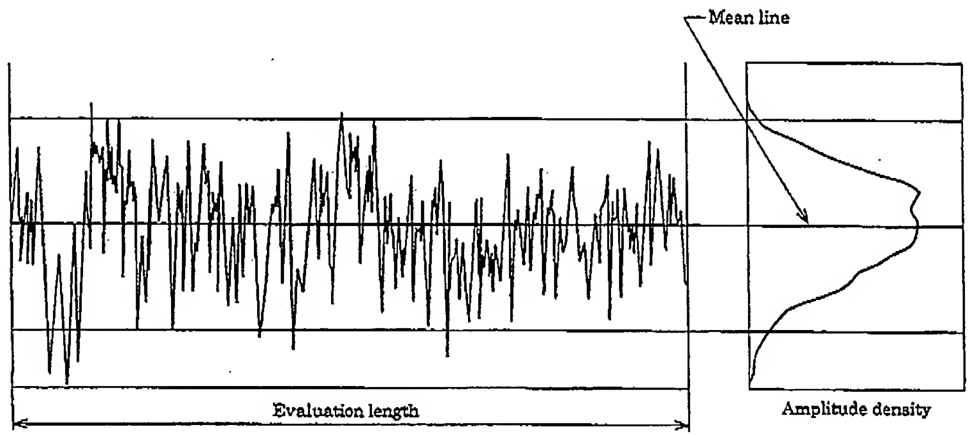


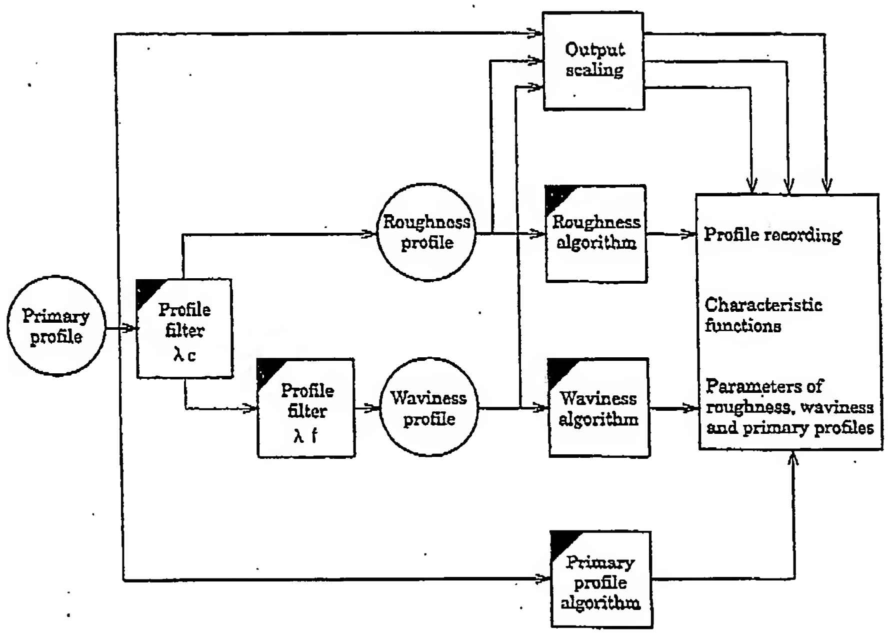
Figure 13 Profile height amplitude distribution curve

Annex A (normative)
Text equivalent

In order to facilitate alphanumeric notation by means of computers, the following text equivalents are recommended:

Parameter	Text equivalent
$P\Delta q$	Pdq
$R\Delta q$	Rdq
$W\Delta q$	Wdq
$P\delta c$	Pdc
$R\delta c$	Rdc
$W\delta c$	Wdc
λs	Ls
λc	Lc
λf	Lf

Annex B (informative)
Flowchart for surface assessment



Annex B Figure 1

Annex C (informative)

Comparison of basic terms and parameter symbols between JIS B 0601 : 2001 and JIS B 0601 : 1994/JIS B 0660 : 1998

Annex C Table 1 Basic terms

Clause in JIS B 0601:2001	Basic terms, JIS B 0601:2001	JIS B 0601:1994 and JIS B 0660:1998	JIS B 0601:2001
3.1.9	Sampling length	l	lp, lw, lr (1)
3.1.10	Evaluation length	l_n	ln
3.2.8	Ordinate value	y	$Z(x)$
3.2.9	Local slope	—	$\frac{dZ}{dX}$
3.2.10	Profile peak height	y_p	Zp
3.2.11	Profile valley depth	y_v	Zv
3.2.12	Profile element height	—	Zt
3.2.13	Profile element width	—	Xs
3.2.14	Material length of profile at the level c	η_p	$Ml(c)$

Note (1) The sampling lengths for the three different profiles are named: lp (primary profile), lw (waviness profile), lr (roughness profile).

Annex C Table 2 Parameters of surface texture

Clause in JIS B 0601:2001	Parameters, JIS B 0601:2001	JIS B 0601:1994 and JIS B 0660:1998	JIS B 0601:2001	Determined within	
				evaluation length ln	sampling length [2]
4.1.1	Maximum profile peak height	R_p	Pp [3]		○
4.1.2	Maximum profile valley depth	R_m	Rv [3]		○
4.1.3	Maximum height of the profile	R_y	Rz [3]		○
4.1.4	Mean height of profile elements	R_c	Rc [3]		○
4.1.5	Total height of profile	—	Rt [3]	○	
4.2.1	Arithmetical mean deviation of the assessed profile	R_a	Ra [3]		○
4.2.2	Root mean square deviation of the assessed profile	R_q	Rq [3]		○
4.2.3	Skewness of the assessed profile	S_k	Rsk [3]		○
4.2.4	Kurtosis of the assessed profile	—	Rku [3]		○
4.3.1	Mean width of the profile elements	S_m	RSm [3]		○
4.4.1	Root mean square slope of the assessed profile	Δ_q	$R\Delta q$ [3]		○
4.5.1	Material ratio of the profile	t_p	$Rmr(c)$ [3]	○	
4.5.3	Profile section height difference	—	$R\delta c$ [3]	○	
4.5.4	Relative material ratio	—	Rmr [3]	○	
—	Ten point height (deleted as an ISO parameter)	R_z	Rz_{JIS} [4]		○

Notes (2) This sampling length is lr, lw and lp for R-, W- and P-parameters respectively; lp is equal to ln.

(3) Parameters which are defined for three profiles: primary profiles, waviness profile and roughness profiles. Only the roughness profile parameter is indicated in the table. As an example, the three parameters are written Pa (primary profile), Wa (waviness profile) and Ra (roughness profile).

(4) Ten-point height of roughness profile is the symbol for parameter used only in JIS, and does not apply to the primary profile and waviness profile.

Informative references 1 If the profile is the roughness profile, Rz is called "roughness of maximum height", Ra is "arithmetic mean roughness" and Rq is "root mean square roughness". In addition, if the profile is the waviness profile, Wz is called "waviness of maximum height", Wa is "arithmetic mean waviness" and Wq is "root mean square waviness".

2 In the original International Standard, t_p is defined as relative material ratio in the 1984 edition, but it was material ratio. The error is corrected in this Standard.

Annex D (informative)
Relationship to the GPS matrix model

For full details about the GPS matrix model, see TR B 0007.

D.1 Information about this Standard and its use This standard is a major rewrite and reorganization of **JIS B 0601** : 1994 and **JIS B 0660** : 1998 that, together with **JIS B 0632** (**ISO 11562**) and **JIS B 0651** (**ISO 3274**), additionally defines the waviness profile, the primary profile and their parameters in a consistent manner.

D.2 Position in the GPS matrix model This Standard is a general GPS standard that influences chain link 2 of the chains of standards on roughness profile, waviness profile and primary profile in the general GPS matrix, as graphically illustrated in Annex D Figure 1.

D.3 Related International Standards The related International Standards are those of the chains of standards indicated in Annex D Figure 1.

Fundamental GPS standards

Global GPS standard

General GPS matrix

Chain link number	1	2	3	4	5	6
Size						
Distance						
Radius						
Angle						
Form of line independent of datum						
Form of line dependent on datum						
Form of surface independent of datum						
Form of surface dependent on datum						
Orientation						
Location						
Circular run-out						
Total run-out						
Datum profiles						
Roughness profile						
Waviness profile						
Primary profile						
Surface imperfections						
Edges						

Annex D Figure 1

Annex E (informative)
Bibliography

1 TR B 0007 *Geometrical Product Specification (GPS)—Masterplan*

NOTE : **TR B 0007** is identical with **ISO/TR 14638** : 1995 *Geometrical Product Specifications (GPS)—Masterplan.*

2 VIM—*International vocabulary and general terms in metrology*, BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993

3 JIS B 0610 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Definitions and designation of rolling circle waviness*

Annex 1 (informative)
Ten-point mean roughness

Ten-point mean roughness is the roughness parameter which is not included in the original International Standard (**ISO 4287 : 1997**) but is left in this Annex for information because it is widely popularized in Japan.

1 Ten-point height of roughness profile Rz_{JIS} In the roughness curve of the reference length obtained by applying a phase compensation zone passing filter of the cut-off values λc and λs, the sum of the mean of profile peaks from the highest to fifth height and the mean of profile depths from the deepest valley to fifth deepest valley.

Remarks : If the maximum height roughness Rz based on this Standard is confused with Rz used for ten-point mean roughness which has been used in the past technical documents, the difference should be shown in note or the like.

2 Definitions of ten-point height of roughness profile given in the former standard The ten-point mean roughness specified in the obsolete standards **JIS B 0601 : 1982**, **JIS B 0601 : 1994** and **JIS B 0660 : 1998** is widely used in Japan and accumulated in the technical documents in the past.

Remarks : The ten-point mean roughness is the same in **JIS B 0601 : 1994** and in **JIS B 0660 : 1998**.

a) **Definition of ten-point mean roughness in the former standard JIS B 0601 : 1994** In the roughness curve of the reference length (roughness curve in the former **JIS B 0601 : 1994**) obtained by applying a phase compensation high-pass filter of the cut-off value λc (phase compensation low-pass filter of the cut-off value λs is not applied), the sum of the mean of five profile peaks from the highest to fifth height and the mean of five profile depths from the deepest valley to fifth deepest valley.

If the difference between the ten-point mean roughness based on the former standard **JIS B 0601 : 1994** and the above-mentioned Rz_{JIS} is anxious, the parameter symbol of $Rz_{JIS\,94}$ is used for the ten-point mean roughness based on the former standard **JIS B 0601 : 1994**. When describing the contents of the symbol, the description in Annex 1 Table 1 is recommended to be seen.

Remarks : The roughness curve defined in the former standards **JIS B 0601 : 1994** and **JIS B 0660 : 1998** does not exist at present.

b) **Definition of ten-point mean roughness in the former standard JIS B 0601 : 1982** The definition is given as the sum of the mean of five profile peaks from the highest to fifth height and the mean of five profile depths from the deepest valley to fifth depth in the primary profile of the reference length (the data measured as they are without any treatment such as filtering). The ten-point mean roughness based on this Standard is that which has been obtained using an analog type surface roughness tester. There may be a difference from Rz_{JIS} defined above as the ten-point mean roughness based on the former standard **JIS B 0601 : 1982**, so that, if it is necessary to distinguish these two symbols,

the parameter symbol Rz_{JIS82} should be used for the ten-point mean roughness based on the former standard **JIS B 0601** : 1982. When describing the contents of the symbol, the description in Annex 1 Table 1 is recommended to be seen.

Remarks : The primary profile defined in the former standard **JIS B 0601** : 1982 does not exist at present, but the total profile (see **JIS B 0651** : 1996) is the profile of the same contents. However, the total profile differs in that it is digital data. If strict difference is required to be indicated, a note showing to be based on analog data or digital data should be given.

Annex 1 Table 1

Symbol	Profile used (example of note)
Rz_{JIS82}	Based on the profile measured as it is.
Rz_{JIS94}	Based on the profile to which phase compensation high-pass filter is applied.

Annex 2 (informative)

Center line average roughness when applying 2RC filter

The definition and designation of the center line average roughness Ra_{75} obtained by applying 2RC analog filter which do not conform to the original International Standard is left in this Annex as information but will be withdrawn at an appropriate time.

1 Terms and symbols For the purpose of this Annex the following definitions apply:

1.1 Cut-off value λc_{75} The wavelength at which the amplitude transmission rate of high-pass 2RC analog filter becomes 75 %.

Remarks : The suffix 75 indicates the attenuation factor 75 % at the cut-off value of the 2RC filter and the difference from digital filter.

1.2 Mean line The straight line or the curve to be the geometrical form of the object surface applied by the least squares to the curve obtained by applying an analog high-pass filter of the cut-off value λc_{75} to the measuring curve at an attenuation factor of 12 dB/oct.

1.3 Roughness curve (75 %) The curve obtained by applying an analog high-pass filter of the cut-off value λc_{75} to the measuring curve at an attenuation factor of 12 dB/oct and expressed with the deviation from the mean line.

2 Definition of center line average roughness

2.1 Center line average roughness Ra_{75} The following arithmetic mean height expressed in μm which can be obtained by using the roughness curve (75 %).

$$Ra_{75} = \frac{1}{ln}\int_0^{ln} |Z(x)|\,dx$$

where $Z(x)$ is the roughness curve (75 %) expressed with the mean line taken as X-axis and the height direction taken as Z-axis, and ln is the evaluation length.

2.2 Cut-off value λc_{75} λc_{75} is of the following six kinds:

0.08, 0.25, 0.8, 2.5, 8 and 25 in mm

2.3 Standard value of cut-off value λc_{75} The standard value of λc_{75} is as given in Annex 2 Table 1.

Annex 2 Table 1

Range of Ra_{75} µm		Cut-off value λc_{75} mm
Exceeding	Max.	
—	12.5	0.8
12.5	100	2.5

2.4 Evaluation length The evaluation length ln shall be at least three times λc_{75}.

2.5 Expression of center line average roughness Ra_{75} The expression of Ra_{75} shall be as follows:

Center line average roughness (75 %)____µm, cut-off value (75 %)____mm, evaluation length____mm.

or

____µm Ra_{75}, λc_{75}____mm, ln____mm.

Remarks 1 When Annex 2 Table 1 is satisfied, the expression of λc_{75} may be omitted.

2 If the evaluation length is at least three times λc_{75}, the expression of the evaluation length may be omitted.

2.6 Preferred number series of Ra_{75} When designating the surface roughness with Ra_{75}, the preferred number series in Annex 2 Table 2 is used in general.

Annex 2 Table 2 Preferred number series of Ra_{75}

Unit : µm

0.013	0.4	12.5
0.025	0.8	25
0.05	1.6	50
0.1	3.2	100
0.2	6.3	

2.7 Sectional designation for Ra_{75} If Ra_{75} is required to be designated with sections, the numerical values of the upper limit (larger value designated) and the lower limit (small value designated) of the division are selected from Annex 2 Table 2 and are written together.

Example 1 When the standard value of λc_{75} is equal to each other at the upper limit and the lower limit.

Example of expression (6.3 to 1.6) µmRa_{75}

In this case, λc_{75} of 0.8 mm is used.

Example 2 When the standard value of λc_{75} is different between the upper limit and the lower limit.

Example of expression (25 to 6.3) μmRa_{75}

In this case, it means that the value of Ra_{75} measured with λc_{75} of 2.5 mm is not more than 25 μm and the value of Ra_{75} measured with λc_{75} of 0.8 mm is not less than 6.3 μm.

Remarks 1 If λc_{75} is required to be the same when corresponding either to the upper limit or to the lower limit, or if other λc_{75} than the standard value given in Annex 2 Table 1 is used, λc_{75} shall be written together.

Example of expression (25 to 6.3) μmRa_{75}, λc_{75}2.5 mm

2 Ra_{75} of the upper limit and the lower limit mentioned here is the mean value of several places sampled at random from the designated surface and is not the maximum value of individual Ra_{75}.

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

Errata will be provided upon request, please contact:
Standardization Promotion Department, Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN
TEL. 03-3583-8002 FAX. 03-3583-0462

100% Recycled paper

2006 – 02 – 09 Printed by JSA